Report on 2015 HRRR reflectivity and echo-top verification

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Implementation of the aerosol-aware version of the Thompson cloud microphysics was accomplished on 1 Jan 2015 into the ESRL RAP-primary (RAPv3) and on 10 April 2015 into the ESRL HRRR-primary (final version of HRRRv2). Initial RAPv3/HRRRv2 code transfer to NCEP occurred in mid March 2015. This task was the culmination of a multi-year effort by NCAR and ESRL for this important improvement in treatment of clouds in the RAP and HRRR models toward improved aviation forecasting. These same versions of the RAPv3/HRRRv2 are being implemented into NCEP operations in fall 2015 as summarized in http://ruc.noaa.gov/pdf/HRRRv2-RAPv3-2015.png .

Reflectivity

First, we report on reflectivity results from testing of the final RAPv3 and HRRRv2 cloud and precipitation hydrometeor analysis including three one-month retrospective periods. For this report, we focus on results for testing for July 2014.

Initial results of the Thompson aerosol-aware microphysics for the 2015 RAPv3/HRRRv2 show an improvement in CSI (Critical Success Index) for forecasted reflectivity at nearly all forecast hours for several thresholds including 25 and 30 dBZ (near VIP level 2). Improved (higher) CSI results from the new 2015 HRRRv2 version with aerosol-aware microphysics (combined with other changes) are evident for forecast durations from 1h to 15h.

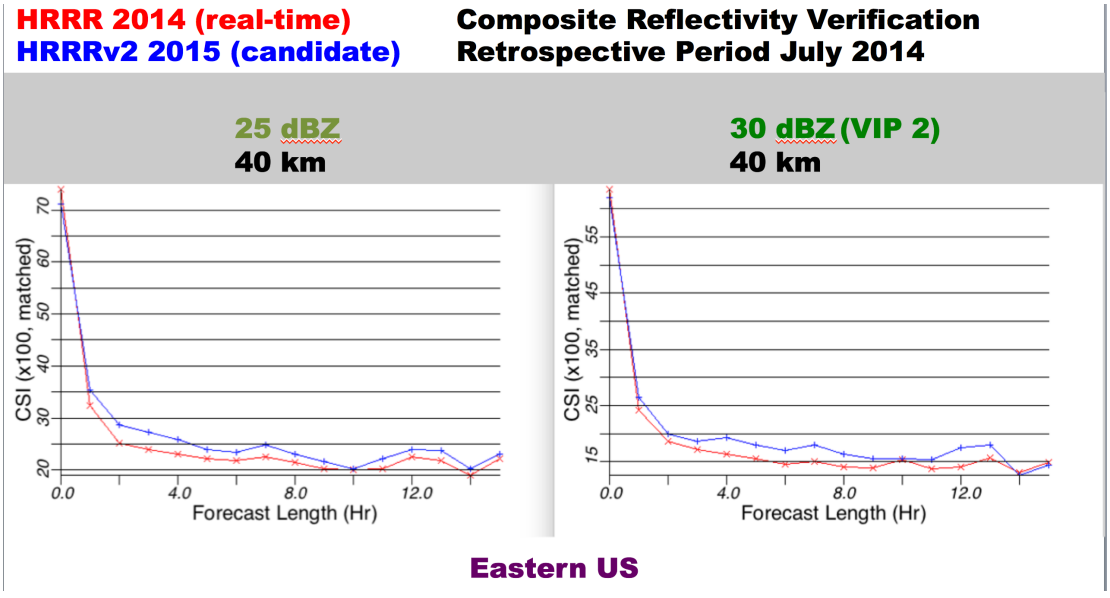

Figure 1. Composite reflectivity verification for the real-time 2014 HRRR (red lines) and 2015 HRRRv2 configuration retrospective run (blue lines) over the eastern United States

during July 2014. Critical Success Index (CSI) is shown for 25 dBZ (left) and 30 dBZ (right) forecast reflectivities. The CSI values are computed on an upscaled 40-km grid.

Echo-top

Echo-top (ET) diagnosis was switched to the aerosol-aware Thompson microphysics starting on 10 April 2015. The results shown below that the echo-top diagnosis at least for initial cloud hydrometeor fields at 0h duration (analysis) now is being captured much better with the new 2015 version. The implementation of the aerosol-aware microphysics in HRRR-primary on 10 April 2015 did not result in any overall change in the 0h or 3h ET verification.

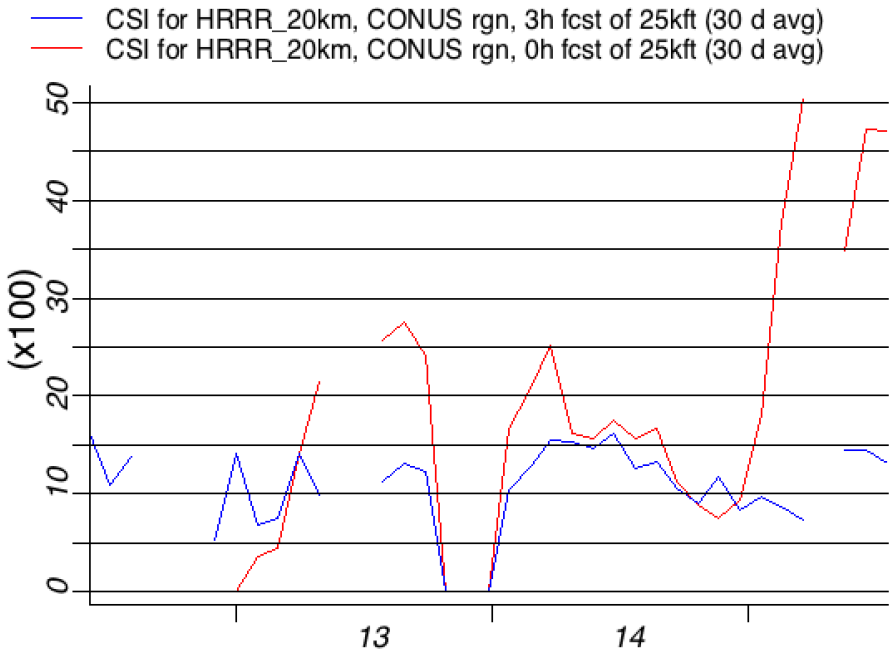

Figure 2. Echo-top verification for 25-kft level for 0h (red) and 3h (blue) forecast duration. Results are shown from 2012 through June 2015 with 30-day averages and 20-km averaging area. Verification is against observed 3-d radar data with diagnosed echo top.